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COVID-19: HAPPY NEW YEAR?  
(JANUARY 2021)

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A complete listing of his writings at <http://psychologywritings.synthasite.com/>.

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# **1. INTRODUCTION**

Lawton et al (2021) began their overview of the state of affairs at the turn of the year thus: "If 2020 felt hellish, be warned that we aren't out of the fire yet, even if we are moving in the right direction. Welcome to 2021, aka purgatory" (p8). "Purgatory" here referred to a situation where "some people are protected but not others" (Lawton et al 2021 p8) <sup>1</sup>.

A key reason is the logistics of distributing, limited vaccines. For example, Cook and Farrar (2020) predicted a year for two doses of vaccines per person to vaccinate the whole UK population with 1000 vaccination centres each vaccinating 5000 people a day for five days a week, and assuming no snags (eg: import delays post-Brexit; Lawton et al 2021).

Also immunity may take some time to develop after vaccination, as well as the remaining unanswered questions around the strength and duration of immunity (Lawton et al 2021).

There is the possibility of unexpected events, like the appearance of a new, more transmissible, variant of SARS-CoV-2 in south-east England in December 2020 (Hardy 2020) <sup>2</sup>.

Public health experts see vaccination as one of many layers of defence at this stage, and the non-pharmaceutical interventions should continue in the meantime (eg: masks and social distancing). This has been called the "Swiss cheese model of pandemic defence" - "each layer has holes, but stack them up and it is much harder for a virus to sneak through" (Lawton et al 2021 p10).

Clear improvements in knowledge occurred through 2020. Cook and Farrar (2020) summed up: "Diagnostics have improved in sensitivity, specificity, speed and accessibility. We have reliable knowledge about which drugs save lives (dexamethasone) and which do not (eg: hydroxychloroquine, azithromycin, remdesivir and the combination of lopinavir and ritonavir). Mortality from Covid-19 has fallen significantly as we have learnt more about the disease" (p1).

However, there are still many unanswered questions

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<sup>1</sup> Cook and Farrar (2020) commented that "there is a false dichotomy in separating the pandemic health of nations from wealth preservation – it is clear that those countries that have managed the pandemic best from a health perspective have also seen the least impact on their economies, and vice versa" (p1).

<sup>2</sup> Named as B.1.1.7 variant (Lu and Vaughan 2021).

about covid-19, and the vaccines, including (Cook and Farrar 2020):

- How well will elderly, frail and co-morbid individuals (ie: those with the greatest vulnerability to severe covid-19) be protected by a vaccine?
- How will efficacy in clinical trials translate into real-life effectiveness <sup>3</sup>?
- Will a vaccine be equally effective throughout the world?
- What is the duration of protection?
- Whether to enforce vaccination, particularly among vaccine hesitant and refusal groups?

Cook and Farrar (2020) ended with a dose of reality: "It is certain that however effective a vaccine or vaccines are, they will not be a final solution to covid-19. This is now a human endemic infection, which will not disappear, and like all infectious diseases, we will need to learn to mitigate its impact through adapting our behaviour and access to diagnostics, treatments and vaccines" (p7).

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<sup>3</sup> Efficacy refers to the vaccine in controlled conditions as in clinical trials, whereas effectiveness is the term when the vaccine is used in the general population. Both terms mean the ability of the vaccine to protect against the disease.

## **2. VACCINES**

- 2.1. Chinese-developed vaccine
- 2.2. Vaccine controversy
- 2.3. Miscellaneous

### **2.1. CHINESE-DEVELOPED VACCINE**

The covid-19 vaccine produced by Chinese state-owned Sinopharm has been fully approved by two Arab countries (United Arab Emirates (UAE) and Bahrain), but a lack of publicly available data on it is a problem more widely (Cyranoski 2020). This compares to the published findings on vaccines by Pfizer and BioNTech (eg: Polack et al 2020).

The approval in the Arab countries was for an inactivated vaccine, based on company data of 86% efficacy (from a clinical trial including volunteers in UAE) (Cyranoski 2020).

Many poorer countries are interested in this vaccine, mainly because the USA and Western European countries have pre-purchased Western-developed vaccines. Hong Kong virologist Jin Pong-Yan raised the concern that poorer countries "might have to choose between accepting the vaccine without independent analysis or not getting a vaccine" (Cyranoski 2020 p548).

For example, the UK has pre-ordered 357 million doses of different vaccines, which, if all vaccines "worked", is enough to immunise the whole population (with two doses per person) twice over (Lawton et al 2021). While the "People's Vaccine Coalition" estimated that nine out of ten people in 67 low- and lower-middle income countries will not get a vaccine in 2021 (Lawton et al 2021).

Four groups have been created to deal with the global vaccine response (Cook and Farrar 2020):

- Access to Covid-19 Tools (ACT) Accelerator
- Coalition for Epidemic Preparedness Innovations (CEPI)
- Vaccine Alliance (Gavi)
- COVAX (part of ACT Accelerator)

CEPI and Gavi were set up prior to covid-19 to help generally with improving access to new, underused, and future vaccines.

COVAX encourages its over 170 member-nations to pool their resources rather than enter into bilateral agreements between a country and an individual manufacturer. It also underwrites risk for manufacturers, and "acts to support simultaneous access to vaccines at affordable prices to all countries, irrespective of their ability to pay. It equally seeks to prevent both inequitable vaccine hoarding and the risk of vaccine 'feast or famine' that might occur with bilateral agreements. It enables manufacturers to take on risks that would otherwise be uneconomic, both in choosing to develop a vaccine in the first place and then in the speed and breadth of commitment to it" (Cook and Farrar 2020 p3).

Cook and Farrar (2020) observed: "There is no merit or safety in creating high rates of vaccination and low rates of disease inside one country's borders if this is not replicated throughout the rest of the world. We really are all in this together" (p7).

## **2.2. VACCINE CONTROVERSY**

The vaccines being used in the UK were developed with two doses and a set period in between them (eg: 3 weeks <sup>4</sup>). The UK Government decided on 30th December 2020 to extend the period between doses, and this has caused much controversy (Wilson 2021) (table 2.1).

Another controversy in the UK is the possibility that the second dose would be a different vaccine from the first dose. One critic described this proposal as "abandoning science", while this has been investigated in vaccines against HIV and malaria (known as a "prime-boost" strategy) (Wilson 2021).

In the UK, there is also debate over the targets set by the Government to vaccinate nearly fourteen million high-priority individuals by mid-February 2021. Success depends on factors like the number of vaccination centres, and production and supply issues (Vaughan 2021b).

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<sup>4</sup> Pfizer/BioNTech vaccine 3 weeks; University of Oxford/AstraZeneca 4 weeks (Wilson 2021). Psychology Miscellany No. 144; 10th February 2021; ISSN: 1754-2200; Kevin Brewer

FOR	AGAINST
Allow more people to receive first dose, particularly when faced with a more transmissible variant of covid-19.	Data from clinical trials based on set period between doses.
Some clinical trial evidence for dose time variation. The Oxford/AstraZeneca trial included a 12-week gap, and the vaccine still proved effective (Wilson 2021).	Only a relatively small number of participants had the extended time between doses - 1800 people - and they had not been randomised to different schedules (Wilson 2021).
Good level of protection from one dose alone, Chief Medical Officers for the UK said in a letter to doctors (Wilson 2021).	Both doses needed for the highest protection.
A slower vaccine roll-out allows time for the virus to mutation in the real-world.	Partial vaccination could allow the virus the opportunity to evolve vaccine resistance.
Pragmatism is important - "We are in an emergency" (Deborah Dunn-Walters, chair of British Society of Immunology in Wilson 2021).	Reduced compliance with second dose if time period too long between them (eg: people forgetting).
"The only way that the longer schedule would lead to more deaths from covid-19 overall is if the delay more than halves the amount of immunity provided by the first dose, which is highly unlikely" (Stephen Evans, London School of Hygiene and Tropical Medicine in Wilson 2021).	Ethics of gaining consent for first dose on basis on second dose three weeks later. This includes 600 000 individuals in the UK given the first injection since 8th December 2020 when the vaccination programme began (Wilson 2021).
	Undermine confidence in the vaccination programme, and give ammunition to vaccine critics.

Table 2.1 - Arguments for and against extending the time between doses of the covid-19 vaccine.

### 2.3. MISCELLANEOUS

The response of the body to a vaccine can be influenced by mood. For example, Marsland et al (2006) found a greater anti-body response to a hepatitis B vaccination among self-reported cheerful or relaxed individuals than nervous or tense ones. The role of mood Psychology Miscellany No. 144; 10th February 2021; ISSN: 1754-2200; Kevin Brewer



here has been called a "soft driver of immunity" (Zaraska 2021).

Studies on the flu vaccination show that a positive mood on the day of the injection influences anti-body response weeks later, as does having more social contacts, and being in a satisfying romantic relationship (Zaraska 2021).

### **3. HEALTH BEHAVIOURS DURING LOCKDOWNS**

Health behaviours, like alcohol, tobacco, and substance use, dietary choices, and physical activity, impact health in the short- and long-term, as well as now in relation to covid-19 and severity of symptoms. The relationship of these behaviours to covid-19 lockdowns in early 2020 is now being reported (Naughton et al 2021).

For example, in the UK, where a lockdown began in mid-march 2020, the purchase of alcohol increased sharply, but "simultaneously sales of alcohol through social venues such as pubs and clubs stopped completely as venues closed. This suggests that both absolute alcohol consumption and patterns of alcohol use may have changed" (Naughton et al 2021 p2). Tobacco sales also increased, as did high-sugar calorie-rich foods (Naughton et al 2021).

But national sales data are not the same as studying individuals. Naughton et al (2021) recruited a cohort of UK residents online in April 2020, and using ecological momentary assessment collected details of health behaviours. The 1044 participants were sent text messages daily in the evening for thirty days (10th April - 18th May 2020) to complete a survey. Detailed baseline measures were taken for the pre-covid-19 behaviours, and the daily surveys covered diet (eg: number of portions of fruit and vegetables), moderate to vigorous physical activity (MVPA) (eg: thirty minutes per day), alcohol consumption (eg: number of drinks consumed), and cigarette smoking (number of cigarettes daily) <sup>5</sup>.

The findings about the health behaviours can be summarised as follows:

i) Diet - Participants ate an average of one portion of fruit and vegetables less per day during lockdown compared to pre-covid-19, but there was no change in high-sugar food portions.

ii) Physical activity - There was a drop in the number of days per week that people did thirty minutes or more of MVPA, particularly among participants classed as "covid-19 at-risk", and those living in higher deprivation areas.

iii) Alcohol consumption - The number of drinks consumed per day did not increase, but the number of days

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<sup>5</sup> Copies of the survey publicly available at the Open Science Framework website (<https://osf.io/dm853/>).

in the month where alcohol was consumed did increase. Particular groups here were older adults, keyworkers, and males.

iv) Smoking - There was no change here, in the main.

Overall, most of the changes between pre-covid-19 and lockdown were "towards a worsening of health behaviours. However, this was not the case for all observed behaviour; there were no changes in the consumption of high sugar foods and small increases were seen in strength training. While there was no discernible change in smoking and vaping behaviour across the sample, 10% of smokers reported cessation as a result of the pandemic, and less than half of these reported any smoking one month after baseline" (Naughton et al 2021 p13).

The reduction in consumption of fruit and vegetables was most worrying for the researchers, and, if it continued over the longer term, it would be associated with a small increased risk of all-cause mortality and cardiovascular diseases.

Some behaviours showed complex patterns, like alcohol consumption, where "women drank more frequently but men drank more quantity in lockdown" (Naughton et al 2021 p14).

This study showed the immediate health behaviour changes with the lockdown, and overall the unhealthiest behaviour change was associated with being younger, and having a high body mass index.

Naughton et al (2021) noted that "it is not surprising that restrictions on movement outside of the house and a greater difficulty in obtaining groceries due to a surge in 'panic buying'... or fear in leaving the house may have led to a less healthy lifestyle for many. On the other hand, if short-term changes remain as longer term habits, then long-term health could be compromised as a result. As younger people in general displayed more 'unhealthy' changes than older people, the net impact on health outcomes of any long-term changes in habit would be greater as younger people have more life years ahead of them" (p15). Longer studies would be able to show if there are more permanent health behaviour changes.

There are a number of methodological issues to consider with this study, which can be evaluated under two headings:

## 1. Sample

(+) Large sample.

(+) Purposive targeting of vulnerable groups - high-risk health conditions, living in high deprivation areas, and a self-reported mental health issue.

(-) Volunteers recruited via smartphones and social media advertisements.

(-) The sample was 96% White, and 73% female.

## 2. Measures

(+) The daily surveys were real-time measures of behaviour (ie: recall for previous 24 hours).

(+) The measurement of multiple health behaviours rather than one, "minimised any 'mere-measurement effect', where actual behaviour is influenced by its assessment, as deliberately changing all of the behaviours assessed simultaneously would be challenging" (Naughton et al 2021 p15).

(+) Only 7% of participants withdrew from the study, and the median completion rate was 28 of 30 surveys. This meant that there was missing data. For daily behaviours (eg: number of cigarettes smoked), mean values were calculated ignoring missing days, while overall sub-analyses were completed with certain participants (eg: those with 50% of completed data).

(-) The baseline measures were retrospective - ie: recall of pre-covid-19 behaviour, though it was quite short (2-3 weeks ago).

(-) All measures were self-reports with no independent verification.

(-) Data limited to thirty days.

## **4. VARIED CONSEQUENCES OF A PANDEMIC**

- 4.1. Other diseases
- 4.2. Miscellaneous consequences
  - 4.2.1. Publications
  - 4.2.2. Archiving
  - 4.2.3. Technology
  - 4.2.4. Relationships
- 4.3. Non-covid
  - 4.3.1. The environment
  - 4.3.2. Heatwaves
  - 4.3.3. Resistant fungal infections

### **4.1. OTHER DISEASES**

It seems that social distancing, lockdowns, and other control measures for covid-19 are reducing the seasonal flu and respiratory viruses seen in the northern hemisphere-winter (Servick 2021).

The WHO described the levels in December 2020 as at "inter-seasonal levels", "meaning it's as low as in an ordinary summer" (Servick 2021 p224). While in the USA, under 1000 positive cases have been recorded in laboratory tests (between September and December 2020) compared to over 60 000 in the 2019-20 flu season (Servick 2021).

A contributing factor is the increase in flu vaccinations as part of governments' policies in Europe and the USA (Servick 2021).

But there are three potentially negative consequences to less flu cases in a winter (Servick 2021):

a) Less samples for researchers who monitor for variants of the flu virus, and decide on the composition of the next flu vaccination in northern hemisphere-winter 2021-22.

b) A "bounce-back" next year with increased cases, as modelled by Baker et al (2020), for example.

c) Increased outbreaks outside the peak virus season. This has occurred in Australia, with reduced respiratory syncytial virus (RSV) cases in the southern hemisphere-winter 2020 (peak season), but an increase in October 2020 (early summer - outside peak season).

## **4.2. MISCELLANEOUS CONSEQUENCES**

### **4.2.1. Publications**

A flood of research on covid-19 appeared throughout 2020. For example, submissions to journals published by Elsevier rose by 58% in February-May 2020 compared to 2019, while it was estimated that around 4% of the world's research output focused on coronavirus (Else 2020).

Pre-print publication is popular - eg: over 30 000 articles related to covid-19 in 2020 (ie: one-tenth of all pre-prints) (Else 2020).

### **4.2.2. Archiving**

Medical historians often lament the lack of information about past pandemics, and this has led to a "global frenzy" to collect "things" about covid-19 for future historians (Spinney 2020). For example, the US National Library of Medicine launched a web archive of websites and social media posts on 30th January 2020, even before covid-19 was named (Spinney 2020).

Erli (2020) described covid-19 as "the first worldwide digitally witnessed pandemic" (quoted in Spinney 2020).

"Collectors are motivated by an awareness that something historic is unfolding, and that past pandemics were relatively poorly documented. Some archivists warn that future historians will have more data than they can make sense of. Others worry about blind spots" (Spinney 2020 p579). Scientists, politicians, and front-line health workers do have time to worry about archiving, while some parts of the world have little documentation. This is similar to the 1918 pandemic, where Asia and Africa - the continents of highest mortality - were "the least well documented" (Spinney 2020 p580).

Also in some parts of the world, pandemics are a continuous story. For example, Geissler and Prince (2020) noted how in Kenya, people have experienced "a long century of epidemics and anti-epidemic measures of varying duration and intensity" (quoted in Spinney 2020).

### **4.2.3. Technology**

Any efforts to reduce time spent on smartphones and computers pre-covid-19 has been reversed in 2020.

Smartphone use increased for nearly half of respondents in one survey, as did time online (3.5 hours per day average in September 2019 to 4 hours in April 2020) (Caddy 2021).

#### **4.2.4. Relationships**

"Social capital", defined as "the various connections that an individual might have that provide them with some kind of resource" (eg: emotional support; information; practical help) (Vanessa Park in Robson 2020), is associated with health. For example, Holt-Lunstad et al (2010) calculated that lack of social connections was a comparable health risk as smoking up to fifteen cigarettes per day, for example.

How does this apply to covid-19 and social distancing? Social bonds have not disappeared, but "social capital is nevertheless leaking away" in three ways (Robson 2020):

i) Loss of "shared experience" - ie: the emotional closeness that comes from doing things together.

ii) Lack of non-sexual physical touch.

iii) Loss of "weak ties" - Every day there are interactions with vague acquaintances (eg: regular commuters seen; distant work colleagues) (estimated at 11-16 per day; Gillian Sandstrom in Robson 2020), and their importance to well-being is underestimated.

### **4.3. NON-COVID-19**

#### **4.3.1. The Environment**

The "same old question lingers: when will life get back to normal?" (The Leader 2021 p5). This same article stated: "A better question, though, is what kind of normal should we be striving for now?" (The Leader 2021 p5). The point was to remind us that climate change, particularly among other things, continued during covid-19. So, 2021 is an opportunity to look at other events than the pandemic.

Vaughan (2021a) noted the worry that 2021 will see a global carbon dioxide emissions rebound after "an unprecedented 7%" fall in 2020. If governments' stimulus packages are "green" (eg: encouraging cycling; investment

in environmentally friendly projects), that will help (Vaughan 2021a).

## **India**

India State-Level Disease Burden Initiative Air Pollution Collaborators (ISLDBIAPC) (2020) focused on the air pollution situation in India in 2019. Air pollution is manifested in three ways:

i) Ambient particulate matter pollution - "residential and commercial biomass burning, windblown mineral dust, coal burning for energy generation, industrial emissions, agricultural stubble burning, waste burning, construction activities, brick kilns, transport vehicles, and diesel generators" (ISLDBIAPC 2020 p1). Measured as "fine particulate matter with an aerodynamic diameter of 2.5 microns or less" (PM2.5) in a cubic metre of air.

ii) Household air pollution - burning of solid fuels (eg: coal; wood; dung) for cooking.

iii) Ground-level ambient ozone - "produced when pollutants emitted from transport vehicles, power plants, factories, and other sources react in the presence of sunlight with hydrocarbons emitted from diverse sources" (ISLDBIAPC 2020 p1). Defined as average eight hour daily maximum concentration in parts per billion (ppb).

Overall, 18% of total deaths in India in 2019 were attributable to air pollution. Lung and heart diseases were the key health risks. In 2017, the last survey, 1.24 million deaths were attributable to air pollution compared to 1.67 million this time (ISLDBIAPC 2020).

Death of workers or loss of workers due to the burden of disease has an economic impact, estimated at 1.4% of GDP (gross domestic product) by these authors. There is also an impact on children, and future human capital (ISLDBIAPC 2020).

There was great variety between the different states in India.

The authors advocated for air pollution strategies by the national and state governments: "The potential magnitude of the benefits, both for human health and the economy, of investing in air pollution control strategies can be seen in the experience of the USA, where every dollar invested in the control of ambient air pollution



since 1970 is estimated to have yielded an economic benefit of \$30..." (ISLDBIAPC 2020 p10).

### **Hurricanes**

Industrial air pollution can intensify hurricanes by the airborne particles acting as cloud condensation nuclei and facilitating the formation of cloud droplets (Pan et al 2020).

Pan et al (2020) modelled this phenomenon with "Hurricane Harvey", which hit south-east Texas in late August 2017 <sup>6</sup>. This area around Houston has a large number of chemical and petroleum plants, which release particulate matter. It was estimated that the air pollution increased rainfall and lightning by a factor of 2-3.

Other studies have shown that the impact of this hurricane was worsened by urbanisation and human changes in land use, which exacerbated flooding (eg: Zhang et al 2018).

### **Ride-Sharing**

"Ride-sharing", via transportation network companies (TNCs) like "Uber" or "Lyft", has emerged in the 21st century. On the surface, such services should lead to reduced car ownership, particularly in urban areas, with the wide availability of for-hire vehicles. However, Ward et al's (2021) analysis of US data in 224 urban areas for 2011 to 2017 found an average increase in vehicle registrations of 0.7%. It was felt that an explanation for this trend could be an increase in car ownership by those who are or who want to be Uber or Lyft drivers outweighing a decrease in in vehicle ownership among riders" (Liverpool 2021 p20).

The TNCs have, not surprisingly, challenged this study (Liverpool 2021).

#### **4.3.2. Heatwaves**

In summer 2019 in the UK, there was "an unusual extended period of hot weather" (Brimicombe et al's 2021 definition of a heatwave) that included the highest ever recorded temperature, and an estimated 892 excess deaths (Brimicombe et al 2021).

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<sup>6</sup> More than 100 people were killed (Marshall 2021).

It is predicted that summer temperatures will be 5 °C hotter by 2070 <sup>7</sup>, and so preparation is important, but not just in public health. Heatwaves impact critical national infrastructure as well (eg: water supply; buckling railway tracks; digital systems) (Brimicombe et al 2021).

One problem is that there is no agreed "official" definition of a heatwave. For example, the World Meteorological Organisation uses: "A period of marked unusual hot weather (maximum, minimum and daily average temperature) over a region persisting at least three consecutive days during the warm period of the year based on local (station-based) climatological conditions, with thermal conditions recorded above given thresholds" (quoted in Brimicombe et al 2021). The UK Met Office prefers: "when a location records a period of at least three consecutive days with maximum temperatures meeting or exceeding a heatwave temperature threshold" (quoted in Brimicombe et al 2021). Brimicombe et al (2021) explained: "Although subtle these definitions reveal competing criteria for what constitutes a heatwave: the uniqueness of the event itself vs exceedance of a pre-determined temperature threshold, which only adds to confusion when planning to manage the impact of heatwaves, especially when mortality rates can also increase from above average temperatures not just from a heatwave" (p2).

Brimicombe et al (2021) reviewed the literature (n = 183 publications in the 21st century) on UK heatwave preparation policy. The conclusion was that heatwaves were an "invisible risk" (ie: little research and information, certainly compared to flooding; Brimicombe et al 2021). "Communication over what UK residents should do, the support needed to make changes, and their capacity to enact those changes, is often lacking. In turn, there is an inherent bias where research focuses too narrowly on the health and building sectors over other critical sectors, such as agriculture" (Brimicombe et al 2021 p1).

#### **4.3.2. Resistant Fungal Infections**

Fleming (2021) wanted to highlight other infectious threats than covid-19, and, in particular, treatment-

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<sup>7</sup> The global average temperatures in 2020 were 0.6 °C above the long-term average, and so making it "the joint hottest year on record" (Vaughan 2021c). In Europe the figure was 1.6 °C above long-term average, while the southern hemisphere had below-average temperatures (Vaughan 2021c). Psychology Miscellany No. 144; 10th February 2021; ISSN: 1754-2200; Kevin Brewer

resistant fungal infections (eg: *Candida auris*). *C. auris* has been reported as resistant, to varying degrees, to the three anti-fungal medicines - triazoles, amphotericin B, and echinocandins (Fleming 2021).

Between 2015 (the first outbreak in a London hospital) and February 2019, there had been 260 cases in the UK. *C. auris* is fatal in one in three cases if it gets into the bloodstream (Fleming 2021).

Another fungus, *Aspergillus fumigatus*, has shown increased resistance to azoles in Dutch hospitals (eg: 8% of fungal-infected cases were resistance in 2013 to 15% in 2018) (Fleming 2021).

Covid-19 makes individuals vulnerable to fungal infections. For example, 2.5% of individuals in intensive care for covid-19 in an Indian study had treatment-resistant *Candida* bloodstream infections, while covid-19-associated pulmonary aspergillosis (CAPA) has been reported around the world in small numbers (Fleming 2021).

## **5. FOR BETTER, FOR WORSE**

- 5.1. Unmitigated infection and herd immunity
- 5.2. Test anomaly
- 5.3. Face masks
- 5.4. Social distancing
  - 5.4.1. Coronavirus and public holidays
- 5.5. Dying
- 5.6. Chronological quarantine
- 5.7. Zoonotic hosts
  - 5.7.1. Reverse zoonoses

### **5.1. UNMITIGATED INFECTION AND HERD IMMUNITY**

Different countries and regions around the world have responded in varying ways to covid-19, and there are situations that allow for "natural experiments". One such situation is the city of Manaus in Amazonia state in Brazil, where Buss et al (2021) described "a largely unmitigated epidemic".

The city has a population of over two million, and a population density of 158 inhabitants per square kilometre. Covid-19 was first confirmed there in mid-March 2020, and was "followed by an explosive epidemic, peaking in early May with 4.5-fold excess mortality. This was followed by a sustained drop in new cases despite relaxation of non-pharmaceutical interventions" (Buss et al 2021 p288).

This pattern of sharp increase in cases followed by a decline occurs with limited restrictions on a virus. The sharp increase is obviously the contagion, and individuals either develop immunity or die, so there are fewer uninfected hosts and the incidence of the virus declines.

Buss et al (2021) analysed various blood samples in Manaus for covid-19 anti-bodies (as a sign of past infection) (and compared them to a blood donor sample in Sao Paulo) in mid-2020. It was estimated that around 76% of the population of Manaus was infected with SARS-CoV-2 at the peak (known as the attack rate) (compared to 29% in Sao Paulo).

By 1st October 2020, Manaus had a covid-19-confirmed death rate of 1193 per million inhabitants <sup>8</sup>, compared to 1070 in Sao Paulo <sup>9</sup>, 620 in the UK, and 625 in the USA

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<sup>8</sup> There was also 1710 deaths per million from severe acute respiratory syndrome probably caused by SARS-CoV-2 infection (Buss et al 2021).

<sup>9</sup> The population of Sao Paulo is over twelve million, and as population size increases, so does the time for a virus to reach peak infections (Bus et al 2021). Sao Paulo has higher population of older people Psychology Miscellany No. 144; 10th February 2021; ISSN: 1754-2200; Kevin Brewer

(Buss et al 2021) <sup>10</sup>.

Buss et al (2021) offered some possible explanations for the spread of covid-19 in Manaus, including "socio-economic conditions, household crowding, limited access to clean water, and reliance on boat travel in which overcrowding results in accelerated contagion, similar to that seen on cruise ships. The young mobile population with potentially low pre-existing immunity to SARS-CoV-2, as well as the early circulation of multiple virus lineages introduced from multiple locations, may have contributed to the large scale of the outbreak" (p292).

The figure of 76% of the population infected in Manaus at seven months after initial infection is above the theoretical "herd immunity threshold" (HIT) (eg: around 60-70% for a homogeneous population; Fine et al 2011). Sridhar and Gurdasani (2021) suggested a HIT of closer to 90% for SARS-CoV-2. These authors were unsure why the HIT was not reached in Manaus, as to "whether this is due to waning immunity after infection, to a higher HIT than previously anticipated, or possibly a lower attack rate than estimated" (Sridhar and Gurdasani 2021 p231). Buss et al (2021) were worried that "prior infection may not confer long-lasting immunity" (p292). Though the test used to measure anti-bodies could be an issue (Buss et al 2021).

Buss et al (2021) ended: "Manaus represents a 'sentinel' population, giving us a data-based indication of what may happen if SARS-CoV-2 is allowed to spread largely unmitigated" (p292).

"Herd immunity is expected to arise when a virus cannot spread readily, because it encounters a population that has a level of immunity that reduces the number of individuals susceptible to infection" (Sridhar and Gurdasani 2021 p230). Sridhar and Gurdasani (2021) described the study of Manaus as a "cautionary example" that "herd immunity is likely not achieved even at high levels of infection and that it comes with unacceptably high costs" (p230) <sup>11</sup>.

Sridhar and Gurdasani (2021) further commented that the Manaus study showed the spread of covid-19 "appears

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than Manaus, which partly explains the higher death rate for lower attack rate (Sridhar and Gurdasani 2021).

<sup>10</sup> In the "best" countries, the death rate was 36 per million inhabitants in Australia, 5 in New Zealand, and 0.3 in Taiwan (Sridhar and Gurdasani 2021).

<sup>11</sup> Remember that Buss et al (2021) calculated 4.5 times more excess deaths in Manaus in 2020 compared to previous years.

to have occurred relatively uniformly across the population and was not limited to specific sub-sets of people who may have been more exposed. This is consistent with other global evidence suggesting that it is practically impossible to 'shield' the vulnerable or to carry out 'focused protection' given the difficulty of identifying and separating the healthy from the vulnerable. Inevitably, with unmitigated transmission, infection will spread to vulnerable populations, with attendant costs" (p231).

## **5.2. TEST ANOMALY**

Robinson-McCarthy et al (2021) pointed out that there are "now multiple reports of asymptomatic researchers who worked with or near non-infectious SARS-CoV-2 nucleic acids and subsequently tested positive during SARS-CoV-2 surveillance screening" (p244). This is evidence of "false positives" (ie: exposure to non-infectious nucleic acids) as opposed to "true positives" (ie: exposure to active SARS-CoV-2 infections). This is the case with tests for SARS-CoV-2, like polymerase chain reaction (PCR) tests, that are focused on finding the virus's biological presence (eg: nucleic acid).

Robinson-McCarthy et al (2021) made recommendations of extra safety controls for laboratories and individuals working with SARS-CoV-2 (eg: verification of positive PCR tests by other types of tests).

## **5.3. FACE MASKS**

Face mask wearing in public is advocated in some countries/places, but not in others. One explanation for the difference is the limited evidence in relation to SARS-CoV-2.

A literature search by Rader et al (2021) using the terms "mask", "reproductive number", "social distancing", and "SARS-CoV-2" or "covid-19" found two case reports (Hendrix et al 2020; Wang, Ferro et al 2020), and one non-peer reviewed observational study (at the time) (Brauner et al 2020) published between 1st January and 24th August 2020. "Although each study made use of different endpoints, all found significantly lower disease measures with higher rates of mask-wearing" (Rader et al 2021 p2). Evidence from studies of other respiratory infections supports this conclusion (Rader et al 2021).

Concentrating on the USA, Rader et al (2021) used survey data in their study. Over 375 000 individuals were questioned in June and July 2020 via the SurveyMonkey.com platform and the COVIDNearYou digital surveillance website of Boston Children's Hospital.

Respondents were asked about mask wearing in two different situations ("while grocery shopping" and "while visiting with family and friends in their homes") using a four-point scale ("very likely" to "not likely at all"). A composite score was created for likelihood of mask wearing, as well as a measure of amount of time wearing a mask.

Other variables measured included physical distancing by state from other data sources, the community transmission rate (R), and mask mandates by state.

Overall, 85% of respondents were "very likely" to wear a mask to the grocery store, and 40% to visit friends and family. Less than 5% reported "not likely at all" to both situations. Self-reported mask-wearing was higher for women (vs men), non-White (vs White ethnicity), lower income individuals, and older age.

There was a negative relationship between mask-wearing in a state and the R number, controlling for physical distancing. It was estimated that a 10% increase in number of people wearing masks was associated with a three-fold increase in odds of transmission control. "Communities with high amounts of self-reported mask-wearing and physical distancing were predicted by a logistic regression model to have the highest probability of community transmission control" (Rader et al 2021 p6).

There are a number of methodological considerations with this study, including:

a) An anonymous online survey as the method of data collection. Anonymity can encourage honesty, while self-reported measures are dependent on the honesty and accuracy of responses. "Social desirability bias might also cause individuals to report wearing face masks despite not doing so in practice, or vice-versa, which could bias these findings in either direction. The self-reported mask measures also suffer from survey bias more generally and might be under-sampling some groups, including those with lower levels of formal education or little access to the internet" (Rader et al 2021 p8).

A self-report of likelihood of a behaviour is not the same as the actual behaviour - ie: the potential gap between stated attitudes and performed behaviour.

b) It was not possible to establish causality between mask-wearing and R. "It is difficult to disentangle individuals' engagement in mask-wearing from their adoption of other preventive hygiene practices, and mask-wearing might be serving as a proxy for other risk avoidance behaviours not queried (eg: avoiding crowded spaces)" (Rader et al 2021 p7).

The validity of the R calculations during a pandemic, when it is better to establish the transmission rate in retrospect with fuller data.

c) Data sources. Physical distancing was measured using Google community mobility measures (ie: mobile phones), and "might not accurately reflect distancing in areas of lower mobile phone ownership or weaker GPS coverage" (Rader et al 2021 p7).

d) Mask wearing. No details of mask type or the use of face shields with masks.

Mask wearing in two situations only surveyed, and a four-point scale used. More options would give a more nuanced picture.

#### **5.4. SOCIAL DISTANCING**

Assessing the trade-off between health benefits and economic costs of physical distancing for covid-19 has been done by developing models (eg: epidemiological-economic model - Thunstrom et al 2020, and expanded by Newbold et al 2020). Using US data, Kruse and Strack (2020), for example, modelled the optimal timing of introduction of a physical distancing policy, concluding that the optimal policy "allows infections to rise until they are close to the medical system capacity, and then physical distancing measures are rapidly implemented to keep the number of infections below the medical system's capacity constraint for a period of time that dampens or eliminates a second wave of infections" (Newbold et al 2020 p707).

The models vary in their assumptions and parameters (eg: the development of an effective vaccine within one year; the risk of death after infection; increasing infections and consumption together) (Newbold et al 2020).

The epidemiological-economic model of Newbold et al (2020) included the innovative "link between physical distancing and air pollution, as well as the interaction



between pollution and the covid-19 fatality rate" (p707).

The model assessed benefits as averted covid-19 deaths from both mandatory physical distancing and individuals' self-protection decisions, and averted air pollution deaths, while costs were loss of income during the period of physical distancing. A comparison of an uncontrolled scenario with no physical distancing was used.

Based on US data for March-June 2020, four million deaths were predicted in the uncontrolled scenario compared one million in the optimal physical distancing situation. The "optimal control path" was to allow a large number of infections early in the outbreak before physical distancing. "This strategy provides a head start on achieving herd immunity while still preventing the number of people who are infected at any one time to exceed the critical threshold of the health care system. If aggressive physical distancing measures are implemented before many infections have occurred and are maintained at a sufficiently high intensity to keep the number of infections very low over time, then when physical distancing measures are relaxed a second wave of infections will occur because the number of susceptible individuals would still be very high" (Newbold et al 2020 p722).

The model assessed the reduction in fatality risks only, not "other adverse health outcomes short of death" (Newbold et al 2020 p722). No distinction was made between individuals of differing ages and vulnerabilities, nor between symptomatic and asymptomatic cases. The researchers also ignored "a number of other potentially important side-effects of physical distancing, which may include increased incidence of domestic abuse as families spend more time at home, increased fatality rates from other adverse health conditions as people delay treatment to avoid infection in hospitals..., reductions in crime rates..., adverse mental health effects of school closure..., and increased rates of suicide due to social isolation" (Newbold et al 2020 p723). The inequity of economic costs and air pollution effects across society were not modelled - ie: the disproportionate impact on low-income households.

Considering the longer term economic and environmental consequences of covid-19, Newbold et al (2020) discussed four issues:

- i) Covid-19 has led to remote working policies,

distance education, and less travel to in-person meetings. To what degree will these changes continue post-pandemic, and the consequent impact on the economy and the environment?

ii) Where individuals choose to live - in cities or outside. "If large cities are engines of economic growth - a conventional but not a consensus view... - but also come be known as engines of infectious disease outbreaks..., what are the implications for the optimal spatial patterns of human settlements?" (Newbold et al 2020 p724).

iii) The implications for food production and consumption. "Preferences for domestically produced food also might increase, as the covid-19 crisis highlights the urgency for securing a sufficient domestic food supply as a means of enhancing the resilience of local economies in the face of heightened risks of pandemics or other large scale disruptions in the future. Whether this will positively or negatively affect land conservation" (Newbold et al 2020 p724).

iv) How individuals spend their leisure time. "If people become motivated to shift a portion of their time use to outdoor recreation activities - which might pose lower risks of infection than leisure activities indoors or outdoors in large crowds... - this could increase the instrumental value of a clean environment and untrammelled wilderness areas. It also could expand the health benefits from exercise outdoors... and the more general well-being benefits from spending time in nature... On the other hand, if people withdraw from travel both abroad and at home and spend more time indoors watching screens, or if yet another case of a pathogen jumping from an animal species to humans (zoonosis)... makes some people more fearful of close contact with nature, the health benefits of outdoor recreation might contract rather than expand" (Newbold et al 2020 p724).

#### **5.4.1. Coronavirus and Public Holidays**

Public holidays with uncontrolled travels are "super-spreader events" (Guglielmi 2020), including:

- Lunar New Year 2020 in China - Five million people left Wuhan just covid-19 was starting in that city (Chen et al 2020). Another study in Wuhan reported

that if one person in a household is infected, one in three others will also become infected (Wang et al 2020).

- School holidays - eg: February 2020 UK travellers returned from ski-ing in northern Italy (du Plessis et al 2020).

## 5.5. DYING

A "good death" is one where "suffering should be short" (Nelson-Becker and Victor 2020 p1). How does loneliness at death fit with this concern? Nelson-Becker and Victor (2020) answered: "In the loneliness literature, being alone is often equated with being lonely... Loneliness tends to be assessed as a problem, and lonely dying or dying alone is viewed even more fundamentally as a failure by society to acknowledge and provide for duty of care... People who die alone are imagined to have a disturbing death. We who observe it in-person or via media are also disturbed" (p1).

Nelson-Becker and Victor (2020) sought to distinguish between "dying alone" and "lonely dying", and explored them in relation to media representations.

"Dying alone" can mean different things, including (Nelson-Becker and Victor 2020):

- Physically alone as dying.
- Dying in hospital with medical staff, but not family and friends present.
- "[D]ying with people nearby who fail to include the dying person or be attentive to him/her in some key way, or who fail to notice the moment of death" (Nelson-Becker and Victor 2020 p1).

"Dying alone" also has certain connotations linked to living alone in older age, and "this may carry overtones that signal character flaws leading to reclusiveness or a solitary nature, cognitive impairment, or self-neglect" (Nelson-Becker and Victor 2020 p2). On the other hand, those "who live alone may prefer that choice of lone living as it signals independence and control and could be constructed as a marker of successful ageing in place" (Nelson-Becker and Victor 2020 p2).

But "lonely dying" is "dying alone when one is Psychology Miscellany No. 144; 10th February 2021; ISSN: 1754-2200; Kevin Brewer

afraid of that prospect, most especially when one fears death. If people attend the death, they may not be the ones the dying person would prefer. Dying alone is a fear that many people hold... and thus they prefer to be accompanied at their death, even if it is only to be sung into their next life or that great vast void which they may imagine will be the next step. Family and friends who share significant relationships, if they speak of death at all, may express that one of their worst fears would be if a loved one died alone" (Nelson-Becker and Victor 2020 p2).

Nelson-Becker and Victor (2020) searched the archives of two newspapers, the "New York Times" and the "Guardian" using the words "lonely" and "death", and found 22 and 25 articles respectively. Of the "New York Times" articles, they ranged from 1932, and five came from early 2020, while for the "Guardian", six articles came from 2020. Three common themes emerged from the articles:

i) "Dying alone is a non-normative event" - "If you lived well and contributed to society, you deserved a good death, and dying alone was undeserved. If you broke laws (the jewel thief <sup>12</sup>) or implicit norms ('Lonely Death Closes a Woman's Lonely Life' <sup>13</sup>), then dying alone was just recompense, even if it was a bad death per society's assessment" (Nelson-Becker and Victor 2020 p5).

ii) "This death matters" - Here lone deaths were a call to build a better society. For example, a 2014 story in the "Guardian" was titled "No one should die penniless and alone", and reported the story of a man whose legitimate request for welfare benefits was ignored. "His sister described her brother as quiet and private. 'I don't think anyone should die like that in this country, alone, hungry and penniless'" (Nelson-Becker and Victor 2020 p5).

iii) "Where people die alone, societies should honour the death and learn from it" - For example, two quotes from 2020 from the "New York Times": "'This is about a person's life and the respect that has to be given', commented a funeral celebrant for someone unknown who died alone during Covid... 'I pieced together what I think was his life', said one death investigator" (Nelson-Becker and Victor 2020 p5).

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<sup>12</sup> Story in "New York Times" in 1951 entitled "Jewel thief dies alone and broke".

<sup>13</sup> A 1971 story in "New York Times".

Linking specifically to covid-19, "lonely deaths" in hospital, say, may leave families and friends with "disenfranchised grief" (Doka 1989). This means "individuals may experience very strong grief reactions that resist social validation... The person who is grieving, including the person dying who anticipates his/her own death and significant others who anticipate a loss, may not be able to engage in common mourning rituals designed to alleviate the burden of grief. During the pandemic disenfranchised grief may be more prevalent or talked about because of the loss of familiar rituals, such as participating in a funeral. The contingent of allowable public mourners have included immediate family only, leaving out grandchildren who may deeply experience the exclusion. Further if the loss involved a person whose relationship with the decedent could not be disclosed or was unrecognised, for instance, a best friend, co-worker, or secret partner, this too may remain unhealed" (Nelson-Becker and Victor 2020 p6).

Accepting a distinction between "dying alone" as a choice, and "lonely death" (not as a choice), Nelson-Becker and Victor (2020) concluded with these thoughts: "Dying alone must not turn into disenfranchised grief. Where this type of death occurs, and family members or significant others die alone, this should be seen as a result of our shared experience of the pandemic, or simply what occurred. It should be normalised and not be a source of guilt, shame, or blame. Death may be one of the most painful of losses, since it is permanent, pervasive, and unalterable. Our assumptive world is forever changed. However, our cultural and societal response to lonely dying can ease the experience. We must understand that in our culture of choice, the death we experience is not always the death we would choose. As primary grievers, can we learn to accept it, and in our acceptance learn to value the best parts we know about the death that occurred and to trust that those dying were upheld by their environment in some manner? More than this, we can value the life lived that intersected with our own and choose our own moment to honour and remember that life" (p8).

## **5.6. CHRONOLOGICAL QUARANTINE**

In the UK in March 2020, adults aged 70 years and above were advised by the Government to self-isolate for months because of the age-associated risk of covid-19.

Fletcher (2020) described this as "chronological quarantine".

The British Society of Gerontologists (BSG) immediately responded with opposite to a policy based purely on age. "It argued that risk was distributed across the age spectrum, with many older people being relatively less vulnerable and many younger people being relatively more vulnerable. It also questioned the arbitrariness of drawing a boundary at 70, when the risks of two people aged 69 and 70, respectively, were likely comparable" (Fletcher 2020 p3) <sup>14</sup>. Controversially, the BSG described a policy based on chronological age as "ageist". But a response by a former president of the British Geriatrics Society soon after saw the policy saw the policy as "epidemiological practicality" (Fletcher 2020). The debate continued among others, and in other countries (Fletcher 2020).

Fletcher (2020) considered some of the issues raised. Firstly, the tension between population-level and person-level focus. "Generally speaking, public health does not deal directly with persons as we experience them in our daily lives. Instead, it deals with the epidemiologic subject, a hypothetical being who embodies select average characteristics of the wide range of individuals who make up a given population... The 80-year-old epidemiologic subject who contracts covid-19 has a 9 per cent risk of death..., which may differ substantially from the particular vulnerabilities of the specific 80-year-olds who are known to us personally" (Fletcher 2020 p4). This is the "tyranny of averages" as against "aged heterogeneity" (ie: "the diversity of older people"; Fletcher 2020).

Fletcher (2020) commented: "The gerontological assertion of aged heterogeneity in response to chronological quarantine is intellectually sound. However, it is also somewhat hypocritical in that it overlooks the considerable affinities between the government's approach and gerontology's implicit - and often explicit - demarcation of older people and later life as distinct categories. The use of chronological age - the number denoting the years since a person's birth - to delineate the subject matter of gerontology (ie: older people and later life) has been a core contradiction since at least as far back as late 19th century" (p5).

Another issue is the concept of ageism. This is the negative stereotyping of individuals and prejudice based on age, but does that always include discrimination as

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<sup>14</sup> An early article on gerontology in the 1940s described its subject matter as adults aged 40 years and above (Fletcher 2020).

well? Fletcher (2020) was concerned with the problem of defining ageism, and that "chronological quarantine has a more complex relationship with the intersection of discrimination and ageism" (p9). He proposed a definition of ageism as "the assumption of intra-age-category similarities and inter-age-category dissimilarities beyond date-of-birth" (Fletcher 2020 p9).

Any regulation in society that has an age-related basis (eg: minimum age to purchase alcohol) means that "age discrimination is common in many aspects of life, especially regarding younger people, and rarely warrants accusations of ageism" (Fletcher 2020 p9). Such policies, and chronological quarantine, could be described as "pragmatic ageism" (Fletcher 2020). As Fletcher (2020) concluded, chronological quarantine is "slightly" ageist "given its reliance on the assumption that age denotes distinct types of people, envisioned in terms of the aged epidemiologic subject... yet it simultaneously draws our attention to life-threatening risk and inspires a practicable means of lowering that risk" (p11).

## **5.7. ZONOTIC HOSTS**

Land use change, from natural habitats to agricultural, urban or other human use, increases the infection risk for humans. "Land use change directly and indirectly drives the loss, turnover and homogenisation of biodiversity (including through invasions and rare species losses), modifies the structure of the landscape in ways that modulate epidemiological processes (for example, fragmentation and resource provisioning) and can increase contact between humans and wildlife (for example, through agricultural practices and hunting)" (Gibb et al 2020 p398).

Gibb et al (2020) focused on zoonotic hosts - species that harbour diseases that could be a risk to human health. These researchers studied the data from 6801 sites of land change around the world. Zoonotic host species "either persist or increase in response to land use, against a background of consistent declines in all other (non-host) species in human-dominated habitats" (Gibb et al 2020 p399). For example, among 1868 passeriformes species of birds with data available, sixty-two were classed as hosts, and they increased by 100% in urban areas compared to natural habitats, while non-hosts declined by around 50%.

The general pattern of the findings was evident as measured by both "site-level host species" (ie: number of

host species), and "host total abundance" (ie: total number of host individuals).

Further analysis tried to explain the findings, particularly focusing on mammals. Host species (eg: rodents) have "resilience to anthropogenic pressures" (Gibb et al 2020 p400) compared to non-hosts (eg: carnivores).

This study shows the risk of "pathogen spillover" from anthropogenic land use, though the actual emergent disease risk will depend on factors like pathogen prevalence and host populations, for example (Gibb et al 2020). "The global expansion of agricultural and urban land that is forecast for the coming decades – much of which is expected to occur in low- and middle-income countries with existing vulnerabilities to natural hazards – thus has the potential to create growing hazardous interfaces for zoonotic pathogen exposure" (Gibb et al 2020 p401).

### **5.7.1. Reverse Zoonoses**

Conceicao et al (2020) considered "reverse zoonoses" - the jumping of SARS-CoV-2 to companion animals and livestock from humans - and the angiotensin-converting enzyme 2 (ACE2) receptor on cells as access for the virus. The virus binds to that receptor via the spike protein.

Conceicao et al (2020) investigated the spike protein and ACE2 receptor in twenty-two vertebrate species (9 companion animals, seven livestock species, four bat species, and 2 potential hosts - eg: civet). Dog, cat, and cattle species had ACE2 receptors "most permissive to SARS-CoV-2" (Conceicao et al 2020 p1), and so the potential for reverse zoonoses is there.

However, the researchers pointed out that "although the potential for SARS-CoV-2 to spread by reverse zoonosis appears real, and there is evidence for community-based infections in mink, tigers, cats, and dogs, the epidemiological significance of these infections remains to be determined. More thorough investigation, including heightened virus surveillance and detailed experimental challenge studies, are required to ascertain whether livestock and companion animals could act as reservoirs for this virus" (Conceicao et al 2020 p16).



## **6. MISCELLANEOUS**

### 6.1. Intelligence

#### **6.1. INTELLIGENCE**

Sternberg (2021) criticised traditional IQ-based views of intelligence as increasing social barriers rather than breaking them down. "Parents who were able to give their children the schooling, socialisation and other experiences that allowed them to do well on narrowly focused tests and examinations gained a huge advantage - a self-perpetuating one, as those children then gained the opportunities that allowed them to pass on the same advantage to their own kids. Meanwhile, the test themselves were shot through with the narrow view about what constituted intelligence held by a largely white, well-to-do individuals with a certain academic background who created the tests" (Sternberg 2021 p39).

Sternberg (2021) preferred to talk of "adaptive intelligence", consisting of four kinds of skills:

- Creative
- Analytic
- Practical
- Wisdom-based.

He applied them to the covid-19 vaccine. "Creative thinking was needed to come up with the new mRNA vaccines that have proved successful. Analytical skills are needed to ensure that the vaccine trials are scientifically rigorous and the data from them properly interpreted. Practical abilities are needed to upscale the work of research scientists and produce billions of doses of vaccine... Decision-makers need to have wisdom to recognise that there will be many people with other interests - people who are afraid of the vaccine, people who are generally anti-vaccine, people who object for political, religious or ideological reasons - and to develop strategies to convince them of the need to get themselves vaccinated for the common good" (Sternberg 2021 p40).

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